

NON-PUBLIC?: N
ACCESSION #: 9108220168
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Beaver Valley Power Station Unit 1 PAGE: 1 OF 05

DOCKET NUMBER: 05000334

TITLE: Reactor Trip and Feedwater Isolation due to Steam Generator Level
Control Malfunction
EVENT DATE: 07/20/91 LER #: 91-022-00 REPORT DATE: 08/19/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 021

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: T. P. Noonan, General Manager TELEPHONE: (412) 643-1258
Nuclear Operations

COMPONENT FAILURE DESCRIPTION:
CAUSE: A SYSTEM: JB COMPONENT: XXXX MANUFACTURER: XXXX
X BA PIS I204
REPORTABLE NPRDS: N
Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On 7/20/91, the station was at 21 percent power and preparing to increase load. The operators placed the Main Feedwater Regulating Valves (MFRV) in service using the Station Startup Procedure. When the C MFRV was placed in operation, it opened rapidly, causing C steam generator level to increase to the Hi-Hi Level/Feedwater Isolation (FWI) setpoint. The main turbine and feedpump tripped and the FWI valves closed. Level in the A steam generator decreased to the Lo-Lo Level/Reactor Trip setpoint. All control rods automatically fully inserted. Auxiliary feedwater initiated in response to the main feedpump trip and Lo-Lo steam generator levels. One auxiliary feed recirculation valve failed to open, but did not affect auxiliary feed operation. Investigation found the control circuit for the C MFRV had been mis-wired during a recent control loop

calibration. The control circuit was rewired and the other MFRV circuits were checked and verified to be correctly wired. A Human Performance Enhancement System evaluation of this event has been initiated. This event will be covered in Instrumentation personnel training. There were no safety implications due to this event. A FWI due to Hi-Hi steam generator level and a reactor trip due to Lo-Lo steam generator level are bounded by Feedwater System Transient analyses in Beaver Valley's UFSAR sections 14.1.8 and 14.1.9.

END OF ABSTRACT

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Description of Event

On 7/20/91, the station was in the process of returning to full power operation after completing its eighth refueling outage. When the unit was at 21 percent power, operators transferred feedwater control from the Bypass Feedwater Regulating Valves (BFRV) to the Main Feedwater Regulating Valves (MFRV), per procedure. The A and B MFRV were placed in service without incident. When operators attempted to place the C MFRV in service, it opened rapidly causing C steam generator level to increase. Operators took manual control of the both main and bypass feedwater regulating valves for the C steam generator, but could not stop the level increase quickly enough to prevent the C steam generator level from reaching its Hi-Hi level setpoint. Steam generator level Hi-Hi automatically initiates a Feedwater Isolation (FWI) Signal: The FWI signal tripped the main turbine, tripped the running main feedwater pump, and closed all feedwater isolation valves. In response to the running main feedwater pump trip, both motor driven auxiliary feedwater pumps started and initiated auxiliary feedwater flow.

The turbine trip caused steamline pressure to increase. The steam pressure increase, combined with the main feedwater flow isolation, caused steam generator levels to decrease. Approximately nine seconds after the FWI occurred, level in the A steam generator decreased to the Lo-Lo level setpoint. The Lo-Lo steam generator level signal initiated an automatic reactor trip and an automatic start of the turbine driven auxiliary feedwater pump. All control rods fully inserted in response to the reactor trip signal. Operators entered the Emergency Operating Procedures in response to the reactor trip and stabilized the plant in Operational Mode 3, (Hot Standby). While isolating the auxiliary feedwater system, operators observed that the recirculation valve for the B Motor Driven Auxiliary Feedwater Pump failed to open. This did not affect operation of the auxiliary feedwater system during the event because the valve is maintained in the full closed position when full

auxiliary feedwater flow is going to the steam generators.

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Cause of Event

Investigation determined that the C MFRV had operated incorrectly due to a fault in the control circuitry. Inspection of the circuit found that two feedwater flow input leads had been reversed. These leads are attached to terminals 7 and 8 on terminal board D in primary process rack 21. Review of maintenance work activities found two instances when these wires were disconnected for testing during the eighth refueling outage. On 4/29/91, these leads were lifted and relanded during performance of loop calibration procedure 1CAL-24-L498 on C MFRV control circuit. On 5/26/91, the same calibration procedure was performed a second time, again lifting and relanding the leads. During one of these two calibrations, the two leads were apparently reversed during restoration. This resulted in the wire that belonged on the number 7 terminal being landed on the number 8 terminal and the wire that belonged on number 8 terminal being landed on the number 7 terminal.

The two leads that were switched did not adhere to the normal conventions for color coding and ordering leads. In the primary process racks, black wiring is usually used for the positive signal and white wiring is usually used for the negative signal. Additionally, when leads are connected to a terminal board, the wire opposite them across the terminal board is usually the same color. A review of station design drawings showed that in this case, neither of these conventions was maintained. The wire attached to the number 7 terminal, which the procedure identified as positive was actually white and was connected across the terminal board from a black wire. Similarly, the wire attached to the number 8 terminal, which was identified as being negative, was black and was connected across from a white wire. This was an abnormal configuration and apparently mislead the maintenance technician reconnecting the wires.

A weakness in the methods utilized for controlling wires lifted during this calibration procedure was identified as a contributory cause of this event. The calibration procedure directed two wires to be lifted simultaneously without providing for positive control for their restoration. The procedure only identified the wires by their terminal board terminal number and polarity. The wire color of the lifted leads was not specified. While there are wire identification labels permanently attached to the leads, these labels only list the component the wires are connected to and does not identify the polarity of the wires.

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Investigation determined that the recirculation valve for the B motor drive auxiliary feedpump had failed to open due to a failed pressure switch. When the failed switch (FIS-FW-151B, manufactured by ITT-Barton Instruments, model number 288A-20029) was examined, it was found that its bellows had been over-ranged and had stuck in the full flow position. After the bellows was dislodged, it moved freely. The switch was bench tested and worked properly. No cause for the bellows being over-ranged has been identified. These switches have been inservice in this application since 1983 with no previous similar failures.

Similar Previous Events

Review of station records showed no previous similar reportable events.

Corrective Actions

- 1) The wires to the number 7 and number 8 terminals on terminal board D were restored to their correct configuration. After these wires were repositioned, the C MFRV control circuit operated properly. The circuits for the A and the B MFRV were checked and verified to properly wired.
- 2) This event will be reviewed in training with all Instrumentation and Control (I&C) technicians. The training will emphasize the necessity for maintaining positive configuration control of leads lifted during maintenance activities.
- 3) The Maintenance department is evaluating methods for enhancing positive configuration control of wires lifted during work activities.
- 4) A INPO Human Performance Enhancement System evaluation of this event has been initiated. Additional corrective actions may be taken based on the results of this evaluation.
- 5) Pressure switch FIS-FW-151B was replaced. The new switch was tested and verified to operate properly.

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Reportability

This event is being reported in accordance with 10CFR50.73.a.2.iv as an

event that involved inadvertent ESF/RPS actuations.

Safety Implications

There were no safety implications due to this event. This event is bounded by UFSAR section 14.1.9, "Excessive Heat Removal Due to Feedwater System Malfunctions" which analyzes the inadvertent full opening of a feedwater control valve due to a feedwater control system malfunction.

This analysis verifies there are no safety concerns from this event. The subsequent reactor trip on Lo-Lo steam generator level is bounded by the analysis of UFSAR section 14.1.8, "Loss of Normal Feedwater."

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August 19, 1991
ND3MNO:3175

Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
LER 91-022-00

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

In accordance with Appendix A, Beaver Valley Technical Specifications, the following Licensee Event Report is submitted:

LER 91-022-00, 10 CFR 50.73.a.2.iv, "Reactor Trip and Feedwater Isolation due to Steam Generator Level Control Malfunction".

Very truly yours,

T. P. Noonan
General Manager
Nuclear Operations

DC/sl

Attachment

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